

Claims

I claim:

1. An integrated process of a glass manufacturing facility and an air separation unit, comprising the steps of:
producing at least a first nitrogen stream and an oxygen stream from the air separation unit;
feeding the oxygen stream to a melting furnace of the glass manufacturing facility;
discharging a flue gas from the melting furnace;
heating the first nitrogen stream with the flue gas;
expanding the first heated nitrogen stream; and,
recovering energy from the expansion.
2. The process of Claim 1 wherein the flue gas is at a temperature of about 1000 degrees Celsius to about 2000 degrees Celsius.
3. The process of Claim 1 wherein the first nitrogen stream is heated by heat exchange with the flue gas.
4. The process of Claim 1 further comprising using a low NOx burner in the melting furnace.
5. The process of Claim 1 further comprising the step of preheating the first nitrogen stream.
6. The process of Claim 1 further comprising the step of mixing additional gas with the first nitrogen stream to increase the mass flow of the first nitrogen stream.

7. The process of Claim 1 wherein the glass manufacturing facility is a float glass facility.

8. The process of Claim 1 wherein the step of expanding the 1st nitrogen stream is mechanically attached to at least one of a compressor, electric motor, and a gear, on a single train.

9. The process of Claim 1 wherein the oxygen stream is preheated before feeding to the melting furnace.

10. The process of Claim 1 further comprising at least one step of heating and expanding the expanded first nitrogen stream.

11. The process of Claim 4 wherein the glass manufacturing plant is a float glass facility.

12. The process of Claim 11 further comprising the step of mixing additional gas with the first nitrogen stream to increase the mass flow of the first nitrogen stream.

13. The process of Claim 11 further comprising extracting a second nitrogen stream from the air separation unit and feeding to a float glass forming chamber of the float glass facility.

14. The process of Claim 13 further comprising mixing a hydrogen stream with the second nitrogen stream.

15. The process of Claim 14 further comprising pre-heating the second nitrogen stream.

16. An integrated system of a glass manufacturing facility and an air separation unit comprising:
a glass manufacturing facility comprising a melting furnace and a flue gas vent; and an air separation unit, wherein a first nitrogen stream is extracted

from the air separation unit, heat exchanged with a flue gas from the flue gas vent, and hot expanded whereby energy is recovered from the hot expansion.

17. The system of Claim 16 further comprising means for increasing the mass flow of the first nitrogen stream.
18. The system of Claim 16 further comprising a pre-heater to pre-heat at least one of the the first nitrogen stream, an oxygen stream extracted from the air separation unit and fed to the melt furnace, and a second nitrogen stream extracted from the air separation unit and fed to a float glass forming chamber of the glass manufacturing facility.
19. The system of Claim 16 further comprising extracting an oxygen stream from the air separation unit and feeding the oxygen stream to the melting furnace.
20. The system of Claim 16 wherein the glass manufacturing facility is a float glass facility.
21. The system of Claim 16 further comprising a low NOx burner in the melting furnace.
22. An integrated process of a glass manufacturing facility and an air separation unit comprising the steps:
extracting a first nitrogen stream from the air separation unit;
releasing a flue gas from the glass manufacturing facility;
heat exchanging the flue gas with the first nitrogen stream;
expanding the first nitrogen stream to recover energy.

23. The process of Claim 22 further comprising extracting an oxygen stream from the air separation unit and feeding the oxygen to a melting furnace of the glass manufacturing facility.

24. The process of Claim 22 further comprising preheating at least one of the first nitrogen stream and an oxygen stream extracted from the air separation unit.

25. The process of Claim 22 further comprising increasing the mass flow of the first nitrogen stream.

26. The process of Claim 22 further comprising reheating the first nitrogen stream.

27. The process of Claim 22 further comprising using a low NO_x burner in the melting furnace.

28. The process of Claim 22 wherein the glass manufacturing facility is a float glass facility.

29. The process of Claim 28 further comprising the step of pre-heating a second nitrogen stream extracted from the air separation unit and fed to at least one of the float glass forming chamber and the cooling line of the float glass facility.